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(54) **A CARBURETTOR**

VERGASER

CARBURATEUR

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Description

[0001] The present invention relates to a carburettor, and more particularly to a carburettor of the type disclosed in EP 1078151 B1.

[0002] A problem faced by current engine designers is the increasing need for reduced engine emissions. This challenge is increasingly difficult as the number of engines in use continues to climb and as governments continually introduce more stringent emissions legislation. In this situation, small improvements in the emissions level of an engine can be of significant importance.

[0003] Small two-stroke engines, particularly those for use with hand-held products, are facing ever-stricter emissions control legislation and durability requirements. Yet further legislation is expected in the USA in the near future and this legislation will be particularly severe for such small engines and is expected to include limits not only on unburned hydrocarbons (HC) and carbon monoxide (CO) but also on particulate emissions.

[0004] Two stroke engines are highly desirable due to their characteristics of low weight, small package size, high power to weight ratio and simplicity of manufacture, and low cost in comparison to four stroke engines of the same power output.

[0005] It is known to reduce the exhaust emissions of a two-stroke engine by the use of stratified charge techniques, in which an inlet duct of the engine is divided into two separate passages, referred to as a substantially rich passage and a substantially lean passage. Emissions from a stratified charge two stroke engine may be reduced further using a carburettor such as that disclosed in EP 1078151B1. The carburettor is arranged to direct a rich fuel/air mixture into the rich passage and a weak mixture or substantially pure air into the lean passage at high engine load, when the carburettor butterfly valve is substantially fully open, but to direct a substantially equally rich mixture into both the rich and lean passages at low engine load, when the butterfly valve is substantially closed.

[0006] The engine with which the carburettor is used is of the crankcase scavenged type and is arranged so that the combustion space is filled with a stratified charge, that is to say a charge whose fuel/air ratio varies over the volume of the combustion space, at high engine load but with a substantially homogeneous charge, that is to say a charge whose fuel/air ratio is substantially the same over the volume of the combustion space, at low engine load. This is achieved in the engine disclosed in EP 1078151 B1 by dividing the interior of the crankcase into two or more separate volumes, one of which, referred to as the rich volume, communicates with the rich passage, and the other of which, referred to as the lean volume, communicates with the lean passage. The rich and lean volumes communicate with the combustion space at different positions.

[0007] Under high engine load, the combustion space is scavenged primarily with substantially pure air from the lean volume. The remaining pure air and the rich fuel/air mixture from the rich volume do not mix thoroughly and the charge is stratified. Under low load, there is a similar relatively weak fuel/air mixture in both the rich and lean volumes and the charge in the combustion space is therefore substantially homogeneous.

[0008] It is desirable that the method used to reduce emissions should not adversely affect or reduce performance. The engine power and torque required to operate such devices as chain saws, concrete saws, electrical generators etc. should preferably not be compromised by the emissions reduction equipment.

[0009] It has been found that carburettors as disclosed in EP1078151 B1 may be improved in a way that does not reduce performance at idle or during progression to full load operation.

[0010] The invention is as set out in the independent claims. Preferred features are set out in the dependent claims.

[0011] An exemplary embodiment of the present invention will now be explained in more detail by the following non-limiting description and with reference to the accompanying drawings, in which:

Fig. 1 is a carburettor as found in the invention described in EP 1078151 B1;
Fig. 2 is a carburettor in accordance with the present invention, shown during progression from idle to full or high load operation; and
Fig. 3 is a carburettor in accordance with the present invention, shown at high load operation.

[0012] In overview, the carburettor of the invention provides improved air and fuel management in an air/fuel system known in the art as a 'main venturi'.

[0013] A known split carburettor 18 shown in Fig. 1 is a fixed choke carburettor and includes twin passages consisting of an upper lean passage 44 and a lower rich passage 42. In this carburettor a throttle valve 20 is constructed and operated, and the rich and lean passages are so arranged, that under low load or idling conditions, fuel is introduced from a fuel jet 62 into both the rich 42 and the lean 44 passages as air passes through a venture 70, 70'and therefore into rich and lean volumes of the engine (not shown). However, under high load conditions, substantially only air is delivered through the upper passage 44, and a mixture of fuel and air is introduced into the rich passage 42.

[0014] The carburettor of Fig. 1 has been found to perform as described in EP 1078151 B1. However, some highly rated small two stroke engines that operate at high speed and load have been found to require significantly more air to be delivered through the lean channel 44. In order to achieve the desired emissions reduction, it has been found that up to 60% or even 70% or more of the total engine air flow volume should be supplied through the lean passage or channel 44 rather than through the predominantly rich passage or channel 42.

[0015] As is normal in fixed choke or non-variable choke carburettors, the venturi 70, 70' is a continuous or fully circular annular restriction in the main choke or barrel of the carburettor. It is this restriction, due to the law of conservation of energy, which results in the speeding up of the air flow and a corresponding reduction in air pressure, which draws the fuel from the main jet 62. Also as normally found in carburettors, the throttle shalt or spindle 21, 21' that supports the throttle valve or plate 20 is split to allow the insertion of the throttle plate 20. The throttle plate 20 is secured within the slotted spindle by one or two screws (not shown), which pass through the spindle and are subsequently tightened to lock the throttle plate 20 between the two halves of the spindle 21 and 21'.

[0016] Figures 2 and 3 show a carburettor according to the present invention in which the upper or predominantly lean passage 44 of the split carburettor does not have a venturi section or restriction, but instead has a substantially uniform cross section through the carburettor, and the upper or lean passage 44 is further improved by the removal of half of the throttle shaft 21'. Fig. 2 shows the carburettor at a stage of progression from idle to low load operation. During this intermediate stage, fuel is supplied from an idle orifice 60. As the throttle is opened, progression holes 61 will gradually supply more fuel than the idle orifice 60 until substantially all the fuel for this low load stage will be supplied from the progression holes 61. During progression, the main venturi is not active and the depression created by the restriction of the throttle 20 provides the depression required.

[0017] Referring now to Fig. 3, as the operator demands more power, the progression system can no longer supply a significant volume of fuel and the main throttle plate 20 is opened yet further. Due to the action of the venturi 70' speeding up the airflow and reducing atmospheric pressure, fuel is now preferentially drawn from a main jet 62 located approximately at the throat of the venturi. It can be seen that the venturi, now only fitted into the lower (as seen in Fig. 3) or predominantly rich passage, can affect a speed increase and pressure drop due to the close proximity of a splitter plate 66.

[0018] Furthermore, because of the removal of the upper half of the throttle spindle 21', at substantially full throttle operation when the throttle plate 20 is open at its widest position, an increased volume of air will flow through passage 44, further improving the stratified charging of the engine without compromising the idle, progression or full power operation of the carburettor.

[0019] The carburettor of the invention thus improves the air and fuel management of a two stroke engine. In maximising the airflow through the main venturi and barrel or bore of the carburettor, it is possible for an engine to be fully compliant with emissions regulations whilst maintaining the quality of the idle and progression.

[0020] It is also of significant importance that in manufacture of the carburettor, the carburettor external dimensions are predetermined or fixed with regard to the packaging volume or space available. This is commonly described in the art as the box or cube volume of the carburettor. This feature of the carburettor is particularly important in small handheld equipment in which space is at a premium. Furthermore, it is common for many carburettors to be manufactured from the same die; the die used to produce the blank casting prior to machining and finishing. Thus, a further advantage of the carburettor of the present invention is that it addresses the need for a greater flow rate of air through the lean passage 44 without a substantial re-design in which the external dimensions of the carburettor are altered.

Claims

1. A carburettor for a two stroke engine including a flow duct comprising rich (42) and lean (44) flow passages separated by a partition, at least one fuel jet (62) communicating with the rich (42) passage, the partition including an aperture towards which the fuel jet (62) is directed, and a substantially planar butterfly valve (20) being received in the aperture and disposed on a spindle (21) so as to be pivotable between a first position, in which the flow duct is substantially closed and the aperture is substantially open, and a second position, in which the flow duct is substantially open and the aperture is substantially closed, the flow duct further comprising a venturi section (70') located substantially upstream of the aperture, **characterised in that**: the venturi section (70') extends only partially around a perimeter of the flow duct, within the rich passage (42), and **in that** the spindle (21) is wholly contained within the rich passage (42) when the substantially planar butterfly valve (20) is in the second position.

2. A carburettor as claimed in claim 1, in which the flow duct has a substantially circular cross section and in which the venturi section (70') extends in a radial direction around a portion of the circumference of the flow duct.

3. A carburettor as claimed in claim 1 in which the spindle (21) is generally D-shaped and wholly contained within the rich channel.

4. A carburettor as claimed in claim 1 in which the carburettor is a fixed choke carburettor

Patentansprüche

1. Vergaser für einen Zweitaktmotor mit einem Strömungskanal mit "fetten" (42) und "mageren" (44) Strömungsdurchgängen, die durch eine Trennwand getrennt sind, wobei wenigstens eine Kraftstoffdüse (62) mit dem "fetten" (42) Durchgang in Verbindung steht, wobei die Trennwand eine Öffnung aufweist,

auf die die Kraftstoffdüse (62) gerichtet ist, und wobei eine im Wesentlichen ebene Drosselklappe (20) in der Öffnung aufgenommen und auf einer Welle (21) angeordnet ist, um zwischen einer ersten Position, in der der Strömungskanal im Wesentlichen geschlossen und die Öffnung im Wesentlichen offen ist, und einer zweiten Position, in der der Strömungskanal im Wesentlichen offen und die Öffnung im Wesentlichen geschlossen ist, schwenkbar zu sein, wobei der Strömungskanal des Weiteren einen Venturi-Abschnitt (70') aufweist, der sich im Wesentlichen stromaufwärts von der Öffnung befindet, **dadurch gekennzeichnet, dass** sich der Venturi-Abschnitt (70') nur teilweise um den Umfang des Strömungskanals herum erstreckt, innerhalb des "fetten" Durchgangs (42), und dass die Welle (21) vollständig innerhalb des "fetten" Durchgangs (42) enthalten ist, wenn sich die im Wesentlichen ebene Drosselklappe (20) in der zweiten Position befindet.

2. Vergaser nach Anspruch 1, wobei der Strömungskanal einen im Wesentlichen kreisförmigen Querschnitt hat, und wobei der Venturi-Abschnitt (70') sich in radialer Richtung um einen Teil des Umfangs des Strömungskanals erstreckt.

3. Vergaser nach Anspruch 1, wobei die Welle (21) im Wesentlichen D-förmig und vollständig innerhalb des "fetten" Durchgangs enthalten ist.

4. Vergaser nach Anspruch 1, wobei der Vergaser ein Vergaser mit festem Choke ist.

Revendications

1. Carburateur pour moteur à deux temps comprenant un conduit d'écoulement comprenant un passage d'écoulement riche (42) et un passage d'écoulement pauvre (44) séparés par une cloison, au moins un jet de carburant (62) communiquant avec le passage d'écoulement riche (42), la cloison comprenant une ouverture vers laquelle le jet de carburant (62) est dirigé, et une vanne papillon (20) sensiblement plane étant reçue dans l'ouverture et disposée sur un axe (21) de manière à pouvoir pivoter entre une première position à laquelle le conduit d'écoulement est sensiblement fermé et l'ouverture est sensiblement ouverte, et une deuxième position à laquelle le conduit d'écoulement est sensiblement ouvert et l'ouverture est sensiblement fermée, le conduit d'écoulement comprenant en outre une section de venturi (70') située sensiblement en amont de l'ouverture, **caractérisé en ce que** : la section de venturi (70') ne s'étend que partiellement autour d'un périmètre du conduit d'écoulement, à l'intérieur du passage d'écoulement riche (42), et **en ce que** l'axe (21) est entièrement contenu à l'intérieur du passage d'écoulement riche (42) lorsque la vanne papillon (20) sensiblement plane se trouve à la deuxième position.

2. Carburateur selon la revendication 1, dans lequel le conduit d'écoulement a une coupe transversale sensiblement circulaire et dans lequel la section de venturi (70') s'étend dans une direction radiale autour d'une portion de la circonférence du conduit d'écoulement.

3. Carburateur selon la revendication 1, dans lequel l'axe (21) est généralement en forme de D et est entièrement contenu à l'intérieur du canal d'écoulement riche.

4. Carburateur selon la revendication 1, dans lequel le carburateur est un carburateur à enrichisseur fixe.

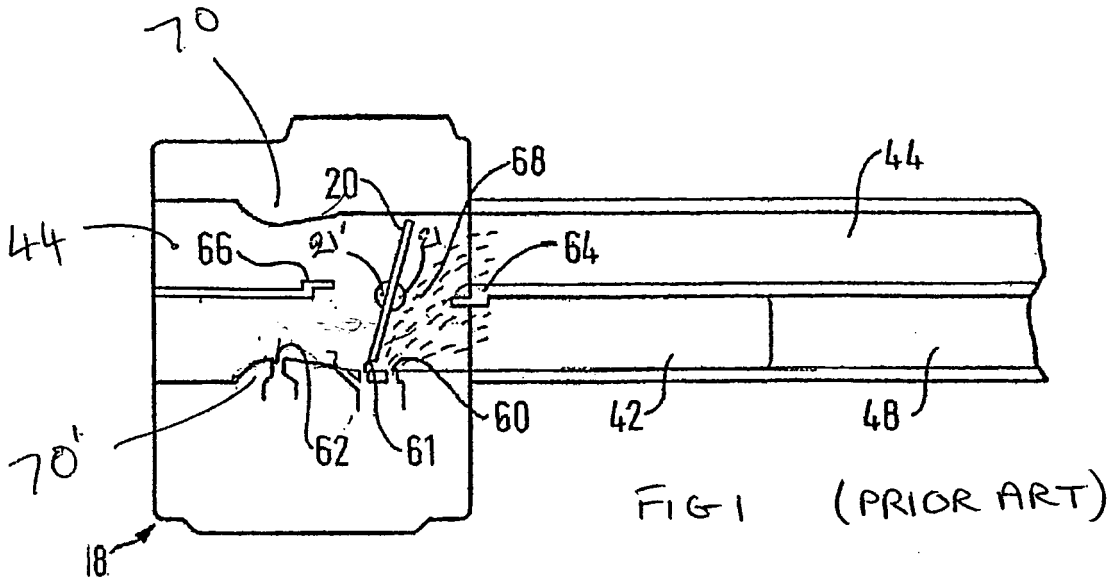

FIG 1 (PRIOR ART)

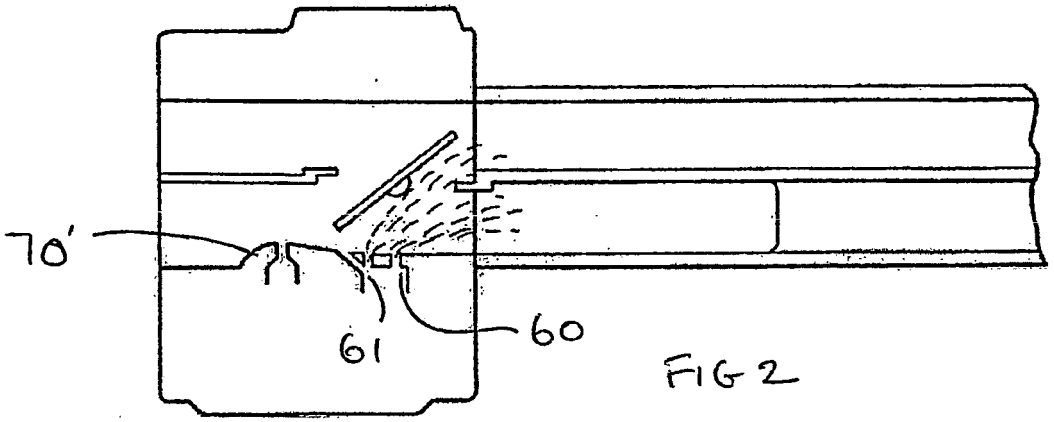

FIG 2

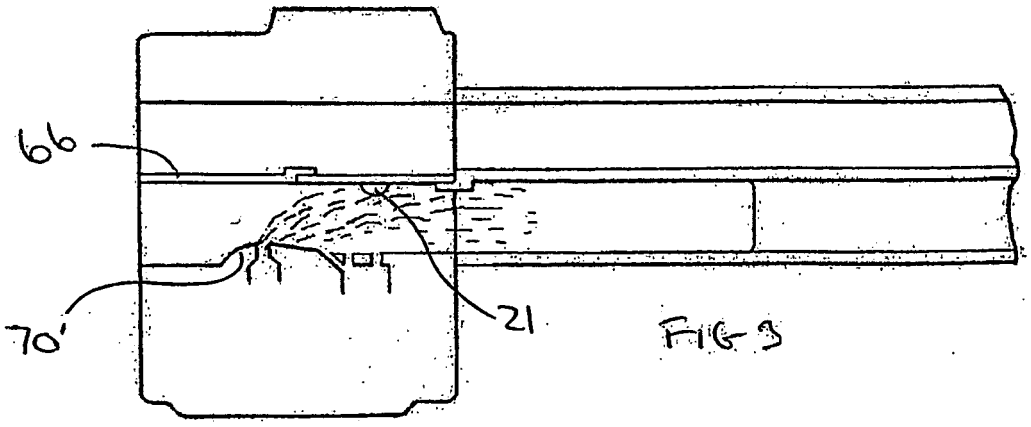

FIG 3

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1078151 B1 **[0001] [0005] [0006] [0009] [0011] [0014]**